Community Assistantship Program

. . .a program of the Center for Urban and Regional Affairs (CURA)

Mapping the Root River Watershed for Improved Implementation of Storm Water Management

Prepared in partnership with
The Fillmore County Soil and Water Conservation District

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Executive Summary

I was hired by the UMN Center for Urban and Regional Affairs to work with UMN Center for Changing Landscapes and the Fillmore County Soil and Water Conservation District to create a series of maps detailing stormwater patterns regionally and locally in the Root River Watershed. Locally, I focused on the City of Preston. I used research, interviews, and GIS mapping to investigate stormwater patterns. Findings indicated that regionally, stormwater flow is impacted by the regions steep topography and primarily agricultural landscape. Locally, Preston can make improvements to the quality of the Root River by changing management of stormwater ponds, land use, and citizen engagement practices.

Figure 1.

Goals and Objectives

The mission of the Fillmore Soil and Water Conservation District (SWCD) is to promote natural resource stewardship by providing educational, technical and financial assistance. The CURA CAP project was intended to determine the storm water drainage areas in selected cities. My efforts focused on Preston, MN, located in Fillmore County. Maps of drainage will provide useful information for doing outreach and education with individual households. Additionally, outreach will extend to interpretive sites that will demonstrate where the storm water is coming from and how the land-use in the area affects water quality and quantity. My goals were to aggregate existing data and develop a series of maps showing storm water drainage areas in the Root River watershed. I coordinated information with Fillmore SWCD, UMN Center for Changing landscapes (CCL) and other sources such as DNR and NRCS. The results will be used by the Fillmore SWCD to develop education and outreach materials to help watershed residents better understand where the water from their property goes, how it affects the watershed, and how they can reduce their impact on the environment. In addition, by identifying where conservation practices are in place, local resource managers can be better informed in targeting practices to the more vulnerable areas. The maps will also be used for a CCL publication on water management design throughout the Root River watershed.

Specifically (in order of priority):

1. Develop GIS maps that locate and identify storm water sources of discharge points, volume of storm water, and boundaries of those storm water inputs and outputs.
2. What are the existing/proposed infrastructures that connect/effect those discharge points?
3. What are current areas that are impacted within the boundaries of these discharge points, and how can citizen action improve/mitigate the impacts of storm water inputs and outputs.
4. Are there areas of greater water quality concern than others?
5. What's the general Root River hydrology?
6. Provide mapping and information that will inform city officials on storm water impacts of inputs and outputs.
7. Practical GIS mapping that can be easily accessed to better assist city officials, and used for outreach.
8. What are current areas that are impacted within the boundaries of these discharge points and how can citizen action and best management practices improve/mitigate the impacts of storm water inputs and outputs?
9. Research different storm events and their impact of these discharge points.
10. Where are the existing conservation practices within the watershed? At what scales? With what effectiveness? Could they relate to the project's site boundaries?

Key Findings

Introduction

Preston is situated in the middle of Fillmore County and well within the driftless region. Southeastern Minnesota has been uniquely impacted by an increasingly volatile climate (Lenhart, 2011). Flooding impacts are more extreme due to coarse topography. As evidenced by programs like "Slow the Flow" out of the Zumbro Watershed Partnership, the issue of flooding and rapid movement of water is becoming the most effective method to communicate and work on water quality issues in SE MN (Zumbro Watershed Partnership). Fast water that drains over urban, suburban, and rural landscapes can lead to flooding downstream. This has an equal opportunity impact in rural/urban settings as well as other types of land cover.

The focus of my study was twofold: (1) What is impacting the water quality in the storm water ponds located along Springfield Ave? and (2) What is impacting the water quality of the Root River in Preston's subwatershed? The main tools for this analysis were: interviews of experts in the field, GIS maps, and a review of pertinent research.

The Stormwater Ponds

Preston's two ponds are fed by storm water infrastructure mostly east of Chatfield Avenue and north of Fillmore St. This water is caught by swales that feed into storm water pipes, which drain to the ponds. This area of the city is composed of steep slopes throughout its neighborhoods and surrounding larger lots. Some areas that may be especially problematic for the ponds are the corn and soybean fields NE of the intersection of highway 52 and St. Paul St. Depending on the landowner's tiling practices, these areas could be feeding excessive nutrients into the southern pond, which has the most issues (Schottler, 2013).

In addition, pond management and design may be factors in the eutrophication (nutrient overload and algal bloom) of the southern pond. It is possible that the design of the pond is inadequate for the high water volume and quantity of pollutants that are currently flowing into it (MPCA, 2000). This pond's size, slope, and location may all be factors leading to such inadequacy. The pond is quite steep sided given that it is located along a highway, which may contribute significant sediment. It would be helpful to find out how much of the flow through the pond comes from surface water and how much comes from piped water. I suggest consulting the city engineer for specific information on water quantities, flow rates, and origin. I did not have the tools to find that information on my own. Storm water ponds are meant to be dredged every ten years. These ponds were constructed in 2005, but given their level of eutrophication, dredging should be considered.

The Root River

The Root River has five impairments in the Preston area as reported to the U.S. EPA: E.coli, fecal coliform, biological impairment of invertebrates and fish, nitrates, and turbidity (See Appendix A) (Koscha et al., 2012).

Factors influencing water quality near the Trailhead Park outlet include: impervious surfaces, coarse topography, highly erodible steep slopes, and land management practices (including private lawns). The main swale in the park is fed from storm water sewers north of Fillmore

Street, east of Chatfield Avenue, and by both storm water ponds. It is important to note here that the water quality of the ponds is an indicator of the water going into the river. All of the factors that impact the ponds are also impacting the Root River in Preston and downstream. Trailhead Park is also home to buckthorn, garlic mustard, and reed canary grass- all invasive species- which do not have the drainage capacity or the erosion prevention properties of their native counterparts (MN DNR, 2013).

Recommendations

The Stormwater Ponds
Preventing nutrients from flowing into the pond is a good place to start improvements since such practices tend to be cheaper than changing the pond itself. According to the topography and piping system in Preston, major sources of excess nutrients are impervious surfaces, lawn care practices, and land management on larger lots. I recommend a neighborhood outreach program to promote proper disposal of leaves and grass clippings, raingarden installation, native plantings, and curbside clean up (EPA, 2012). Increased vegetative buffers for property located on steep hill sides or near the river or other BMPs on surrounding the agricultural areas just outside of the residential area may also prevent excess nutrients from entering the pond (Delaware Department of Natural Resources and Environmental Control). CCL is working on designs to demonstrate these practices in Trailhead Park (Appendix A and B).

Treatment of the pond itself may decrease the incidence of eutrophication. The Environmental Protection Agency (EPA) recommends that wet ponds should always be designed with a length-to-width ratio of at least 1.5:1. The design should incorporate features to lengthen the flow path through the pond, such as underwater berms designed to create a longer route through the pond (MPCA, 2000). Combining these two measures helps ensure that the entire pond volume is used to treat stormwater. Another feature that can improve treatment is to use multiple ponds in series as part of a "treatment train" approach to pollutant removal. This redundant treatment can also help slow the rate of flow through the system. Additionally, a vegetated buffer with native shrubs or trees around the pond area should provide shading and consequent cooling of the pond water. Maintaining lower temperatures will prevent algal growth by reducing the sunlight and head which feed algal bacteria, while also filtering the water running into the pond. If the pond tends to stratify in the summer, Preston might want to consider installing a fountain or other mixing mechanism. This will ensure that the full water column remains oxic and able to process and break down waste (Missouri Department of Conservation).

Figure 2. Typical maintenance activities for wet ponds (EPA, 2012)

Activity	Schedule
· If wetland components are included, inspect for invasive vegetation.	Semi-annual inspection
· Inspect for damage. · Note signs of hydrocarbon build-up, and deal with appropriately. · Monitor for sediment accumulation in the facility and forebay. · Examine to ensure that inlet and outlet devices are free of debris and operational.	Annual inspection
· Repair undercut or eroded areas.	As needed maintenance
· Clean and remove debris from inlet and outlet structures.	Monthly maintenance
· Manage and harvest wetland plants.	Annual maintenance (if needed)
· Remove sediment from the forebay.	5- to 7-year maintenance
· Monitor sediment accumulations, and remove sediment when the pool volume has become reduced significantly or the pond becomes eutrophic.	20-to 50-year maintenance

Trailhead Park

Improvements to stormwater management in Trailhead Park may take two forms: managing stormwater that comes through the park and using design to demonstrate and engage the public in measures to address stormwater issues and how those impact the region in general.

Stormwater may be better managed by the park through implementation of stormwater BMPs (Appendix B). Especially recommended for this park are: live staking, raingardens, preventative techniques and shoreline bioengineering such as coconut logs (Forner, 2013). In addition, the previously discussed methods for improving the ponds will also improve river quality since the ponds outlet directly into the river. Another method for improving the park is invasive species management/eradication. While eradicating reed canary grass is virtually impossible, the park may have some luck dealing with the buckthorn on site (MN DNR, 2013). Please see figure 2 for details on buckthorn management techniques. Special care must be taken when working alongside the river with weed wrenches and chemicals. Round-up in diluted doses is typically recommended over Glyphosate near water bodies. In addition, cutting and stump treating may be better for maintaining soil integrity, rather than using weed wrenches, which can cause excessive erosion. It is typically best to follow up on buckthorn management with native plantings.

Figure 3.

The Root River

While previously mentioned BMPs and other land management changes can make some difference on a small scale, methods for broader neighborhood and regional engagement are necessary to improve the river on a larger scale. Based on research done by Davenport and Pradhananga (2012), I suggest the following outreach strategies:

1. Landowner tailored informational strategies such as individualized audits of practices
- Tie in commitments to behavioral changes to verbal or written pledges- match with particular plan of action
- Include goal setting with frequent feedback

2. Promote civic responsibility, which helps activate social norms
- Message: to be a positive member of the community, one protects water resources
- Demonstration areas are a way to spread the idea that like-minded landowners have adopted conservation practices
- Keep engagement programs as local as possible, down to township or neighborhood scale.

3. Address skepticism about buffers, manage risk assessment
- What are real and perceived costs/benefits to adoption of BMPs?
- Incentives and rewards are generally favored over sanctions (however monetary incentives may only change behavior briefly)
- Information and assistance may have longer lasting impacts- site and individual specific information is key

4. Coordination with multiple water resource entities, and maintain consistent messaging across organizations and agencies.

5. Specific interventions may include:
- Work with landowners in areas that drain into water resources on reducing input of leaves, grass clippings, goose droppings, pet waste, and fertilizer run-off
- Encourage Individual residents can do their part by using fertilizers sparingly, picking up pet waste, composting yard debris, and washing cars on the grass instead of the street
- Promote proactive techniques such as native plantings, raingardens, and decreased turf grass using social pressure, tax incentives, or cost share programs.

Lessard-Sams Outdoor Heritage Council Examples

Project Name: Camp Creek (Fillmore)
Organization Funded: Minnesota Trout Unlimited

Habitat for naturally reproducing trout populations will be enhanced on each of three southeast Minnesota streams using the methods previously described in the "Agricultural area example" above. A total of approximately 2.5 miles of in-stream habitat and stream banks will be enhanced beginning in the 2013 field work season. By leveraging additional funds we hope to complete additional mileage with no additional OHF dollars. Pre-project survey, design and project permitting work will begin in 2012, following a July 2012 appropriation. All projects will consist of sloping and stabilizing stream banks, installing overhead cover for trout, installing erosion prevention measures, and re-vegetating exposed stream banks, including with native prairie species, where appropriate and feasible. All three projects are designed to reduce stream bank erosion and associated sedimentation downstream, reconnect the streams to their floodplains, increase cover (including wintering cover for large trout), increase trout abundance, increase natural reproduction of trout and other aquatic organisms, increase habitat and biodiversity for both invertebrates and other non-game species, increase energy inputs via beneficial sunlight, and increase quality trout angling opportunities.

Project Name: Pin Oak Prairie SNA
Organization Funded: DNR Section of Wildlife

This program will accelerate the restoration and enhancement of approximately 69,000 acres of primarily native prairie vegetation on Wildlife Management Areas, and Scientific and Natural Areas and Native Prairie Bank Easements. Restoration of prairie will occur on 67 acres of severely altered lands by reconstructing native plant communities. These restorations are either in-holdings within a native prairie, or lands surrounding a native prairie. Seed will be collected from native prairies adjacent to the restorations or purchased from vendors with local seed sources. These restorations will expand existing prairie habitat and buffer native prairies from the impacts of adjacent land uses. Funding requested for restoration projects will cover all costs and activities associated with reconstructing a prairie including project design, seedbed preparation, seed harvest, seed installation, and first year weed control. Prairie enhancement activities will be implemented on 1,878 acres of existing and newly acquired prairies throughout the prairie regions of the state. Enhancement activities include 478 acres of woody species treatments and 1405 acres of prescribed burning. Funding requested for enhancement projects will cover all project costs and activities including project design, contract administration, staff time, equipment and supplies. These enhancement activities will focus on native prairies, but may include some restored prairies within the project sites. Many of these native prairie sites harbor rare and unique features, or are located on steep terrain, which require low impact management techniques (e.g. hand cutting of woody encroachment). These specialized prairie management techniques, and the skilled crews that implement them, can incur higher costs than similar lower diversity grassland projects.

Project Name: Spring Valley Hatchery
Organization Funded: DNR

This proposal uses a programmatic approach to achieve prioritized aquatic habitat protection, restoration, and enhancement for lakes, trout streams, and rivers across Minnesota. We propose to: i) protect over 6.8miles (328 acres) of shoreline on lakes, rivers and trout streams; ii) restore and enhance river and stream functions in over 2 miles of in-channel reconstruction that will benefit up to nearly 160 river miles; iii) remove 300 feet(1 acre) of dysfunctional, abandoned in-lake break walls from Lake Mille Lacs; and iv) enhance 9 acres of Mississippi River backwater, wetland, and floodplain habitat by removing accumulated sediments and restoring depth. The strategic approach and priority resources targeted in this proposal are supported by a number of internal and external conservation planning documents. The DNR will implement the objectives of this proposal through established and highly successful programs each having strong stakeholder support including: Aquatic Management Area Program, Stream Habitat Program, and Coldwater Streams Program.

Conclusion

The appended maps and other resources helped inform the recommendations and findings presented here. They also present further information for planning considerations. Outreach may be particularly important in the Preston community given that there are few ways for the residents to connect to the river. In other words, current conditions of recreation and design infrastructure may be preventing people from using, enjoying, or knowing the Root. The Root River does not have any kind of friends group or association of citizens who advocate for it. Typically, rivers with such excellent recreation opportunities have such groups. Additionally, the Root River is a MN DNR Water Trail. Capitalizing on the resources this program offers and getting more citizens to recreate on the river may be an additional aspect of improving quality.

Acknowledgements
Carrie Magnuson, Ramsey Washington Watershed District
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Mary Vogel, Center for Changing Landscapes

Appendix A

SUB-WATERSHED WATER QUALITY IMPAIRMENTS

E. COLI

A TYPE OF FECAL COLIFORM BACTERIA COMMONLY FOUND IN THE INTESTINES OF ANIMALS AND HUMANS

E. coli is short for Escherichia coli. The presence of E. coli in water is a strong indication of recent sewage or animal waste contamination. Sewage may contain many types of disease-causing organisms. E. coli comes from human and animal wastes. During rainfalls, snow melts, or other types of precipitation, E. coli may be washed into creeks, rivers, streams, lakes, or groundwater. When these waters are used as sources of drinking water and the water is not treated or inadequately treated, E. coli may end up in drinking water. The water can be treated using chlorine, ultra-violet light, or ozone, al of which act to kill or inactivate E. coli. Systems using surface water sources are required to disinfect to ensure that all bacterial contamination is inactivated, such as E. coli. Systems using ground water sources are not required to disinfect, although many of them do.

FECAL COLIFORM

BACTERIA THAT ORIGINATE IN THE INTESTINAL TRACT OF MAMMALS

Not all fecal coliform bacteria cause disease, but this relatively simple test is used as an indicator that fecal matter is getting into the waterbody, and that other potentially harmful contaminants may be also be entering the waterbody The main sources of these bacteria are from animal and human waste. Animal sources of bacteria include feedlot and manure runoff, urban runoff, and wildlife. Improperly treated human waste may come from overflows from sewage treatment systems in cities and towns, unsewered areas with inadequate community or individual wastewater treatment, or a single home with a failing septic system.

MERCURY

A METAL THAT RECYCLES BETWEEN LAND AIR AND WATER

Mercury accumulates in fish and often results in fish consumption advisories for lakes and rivers. Mercury can have toxic effects on the nervous system of animals, including humans, that eat large quantities of fish. Mercury is naturally occurring, but most of the mercury entering waterbodies comes from mercury released by human activities. The main pathway of mercury to surface water is through atmospheric deposition. Major sources of mercury to the atmosphere include the burning coal and petroleum, metal smelting, and the use of mercury in manufacturing and products (such as switches, dental amalgam, and measuring instruments).

BIOLOGICAL IMPAIRMENT OF INVERTEBRATES

QUALITY OF INVERTEBRATE HABITAT

The ability to support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to those of natural habitats within a region. Biological integrity is equated with pristine conditions or those conditions with no or minimal disturbance, and it is used as the baseline for the IBI.

NITRATES

CHEMICAL UNITS WHICH COMBINE WITH VARIOUS ORGANIC AND INORGANIC COMPOUNDS

Sources of nitrates include wastewater treatment plants, runoff from fertilized lawns and cropland, failing on-site septic systems, runoff from animal manure storage areas, and industrial discharges that contain corrosion inhibitors. Nitrates in excess amounts they can cause significant water quality problems. Together with phosphorus, nitrates in excess amounts can accelerate dramatic increases in aquatic plant growth and changes in the types of plants and animals that live in the stream. This, in turn, affects dissolved oxygen, temperature, and other indicators. Excess nitrates can cause hypoxia (low levels of dissolved oxygen) and can become toxic to warm-blooded animals at higher concentrations (10 mg/L) or higher) under certain conditions. Hypoxia may cause special risks for infants and pregnant women by reducing the ability of the blood to carry oxygen and resulting in methemoglobinemia or "blue baby syndrome".

TURBIDITY

SUSPENDED SEDIMENT AND PARTICLES

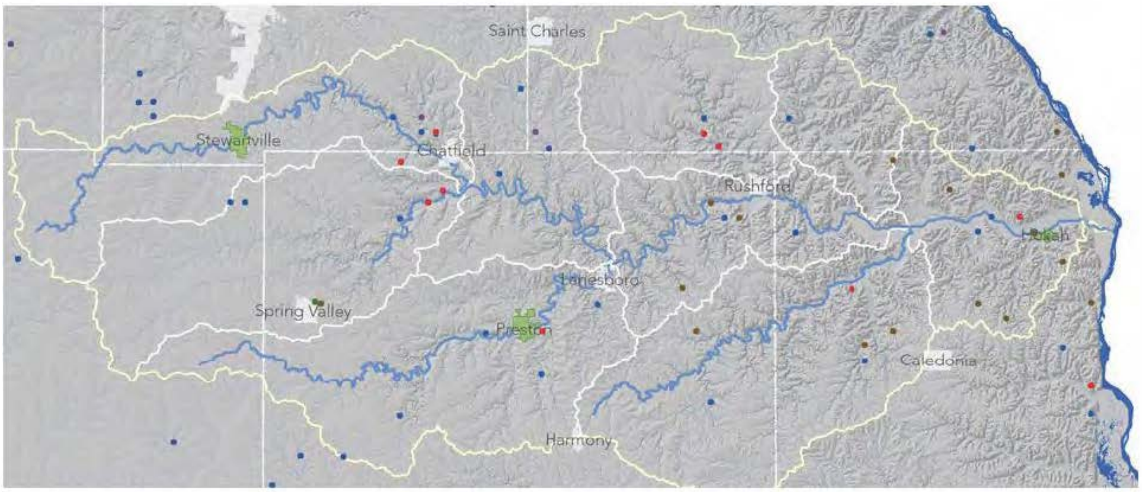
Turbidity is a measure of particles in the water, such as sediment and algae. Related to the depth sunlight can penetrate into the water. Higher turbidities reduce the penetration of sunlight in the water and can affect species of aquatic life that survive in the waterbody. Silt and sediment may cover food sources and render reproduction areas unusable.

BIOLOGICAL IMPAIRMENT OF FISH

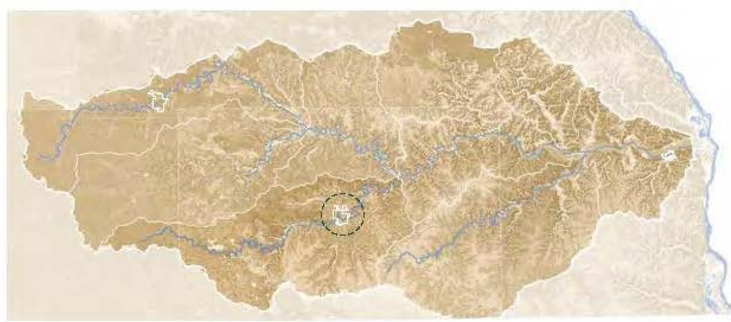
FISH AS AN INDICATOR OF WATER QUALITY

The index of biotic integrity is a regicnally based index used to measure the integrity of rivers and streams, and to determine the level of their biotic impairment. The IBI relies on multiple parameters based on fish community structure and function, to evaluate a complex biotic system. The IBI incorporates professional judgment with quantitative criteria that enables determination of a continuum between very poor and excellent conditions. An important key to successful restoration, mitigation and conservation efforts is having an objective way to assess and compare the biological integrity of damaged sites. The IBI provides a tool for doing so and, at the same time, allows managers to set specific biological integrity targets for restoration programs.

LESSARD-SAMS OUTDOOR HERITAGE COUNCIL SITES



PRESTON SOIL ERODIBILITY



ROOT RIVER SOIL ERODIBILITY & POLLUTANTS

PRESTON EROSIVE RUNOFF AS A RESULT OF OVERLAND FLOW & PROXIMITY TO WATER

ROOT RIVER EROSIVE RUNOFF AS A RESULT OF OVERLAND FLOW & PROXIMITY TO WATER

PRESTON GROUNDWATER SUSCEPTIBILITY TO CONTAMINATION

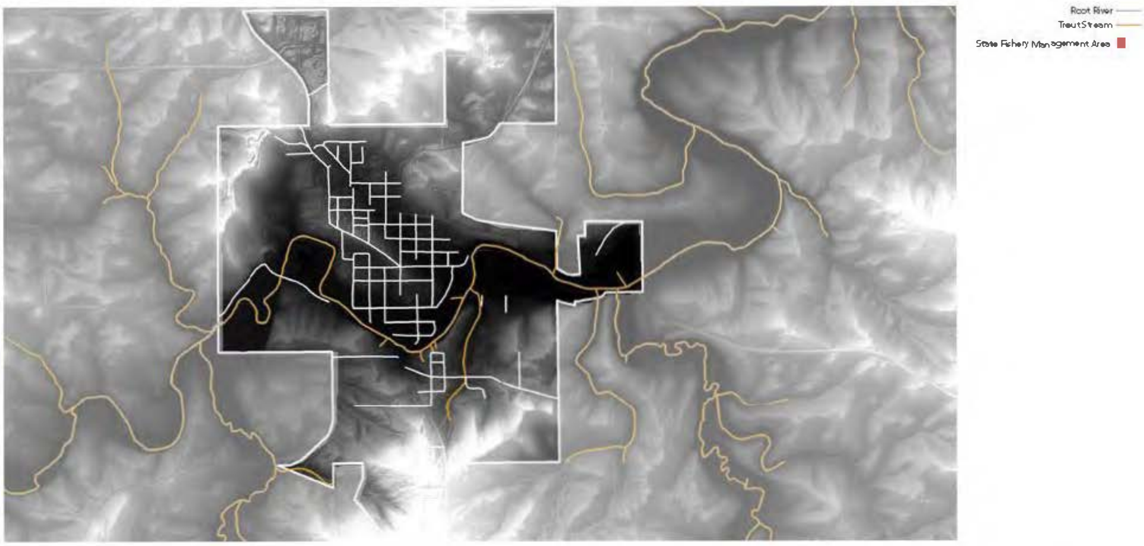
ROOT RIVER GROUNDWATER SUSCEPTIBILITY TO CONTAMINATION

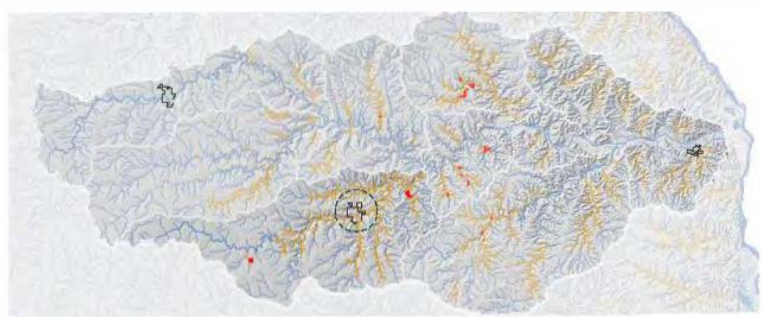
PRESTON AVAILABLE SOIL WATER CAPACITY

Lowest^ Capacity for Water Storage
Lower^ Capacity for Water Storage
Medium^ Capacity for Water Storage
High^ Capacity for Water Storage
Higher^ Capacity for Water Storage

Lowest^ < .11
Lower^ > .11 and <= .15
Medium^ > .15 and <= .19
High^ > .19 and <= .22
Higher^ > .22 and <= .23

PRESTON TROUT STREAMS - THE ENTIRE ROOT RIVER (RUNNING THROUGH PRESTON) IS A FISHABLE FOR TROUT



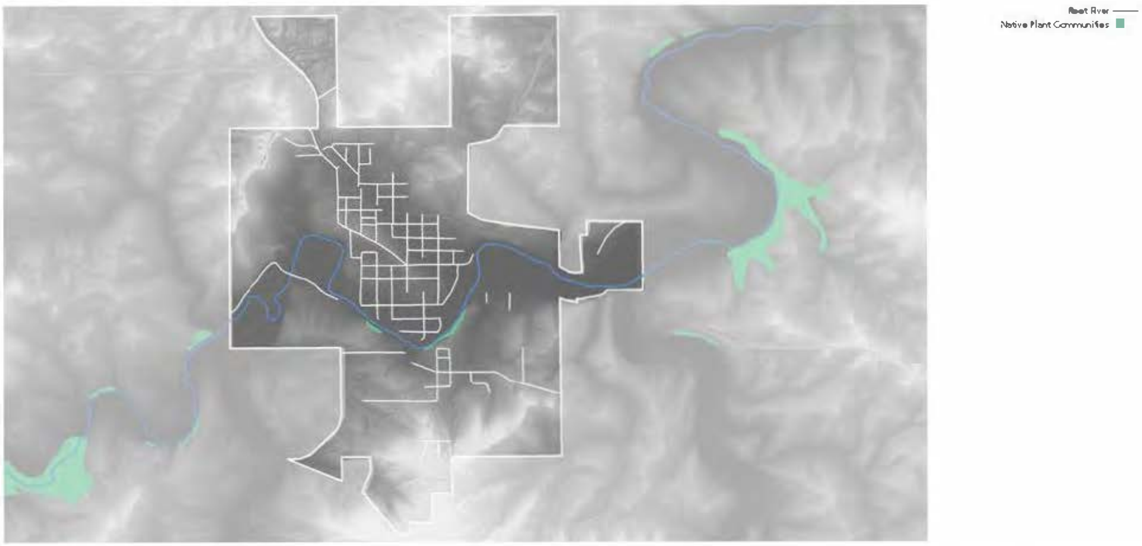


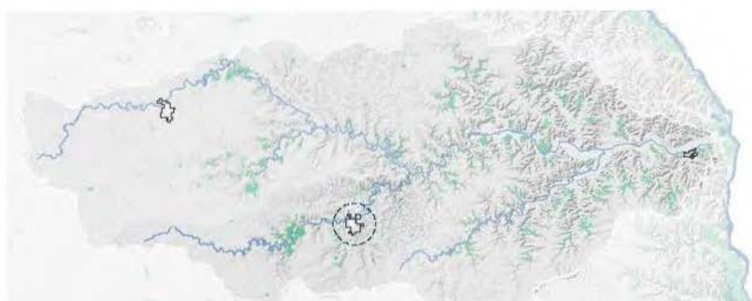
ROOT RIVER FISHERIES AND TROUT STREAMS

PRESTON WILDLIFE HABITAT QUALITY

ROOT RIVER WILDLIFE HABITAT

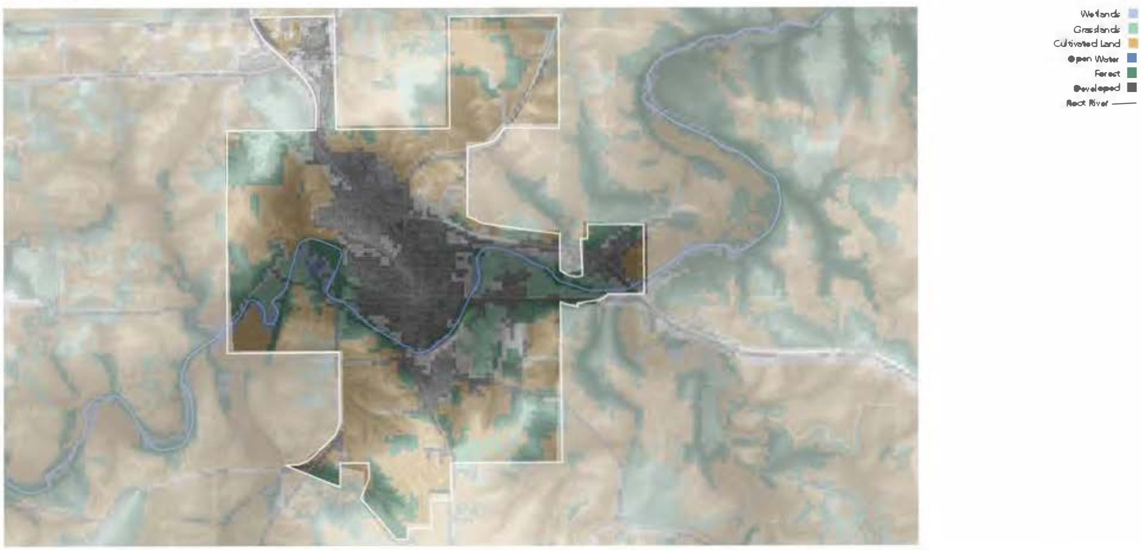
PRESTON NATIVE PLANT COMMUNITIES

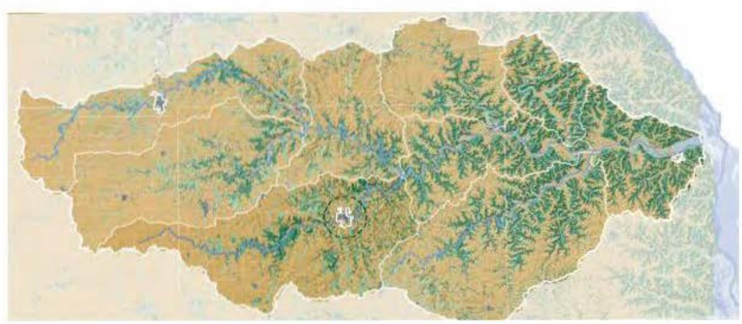




ROOT RIVER NATIVE PLANT COMMUNITIES

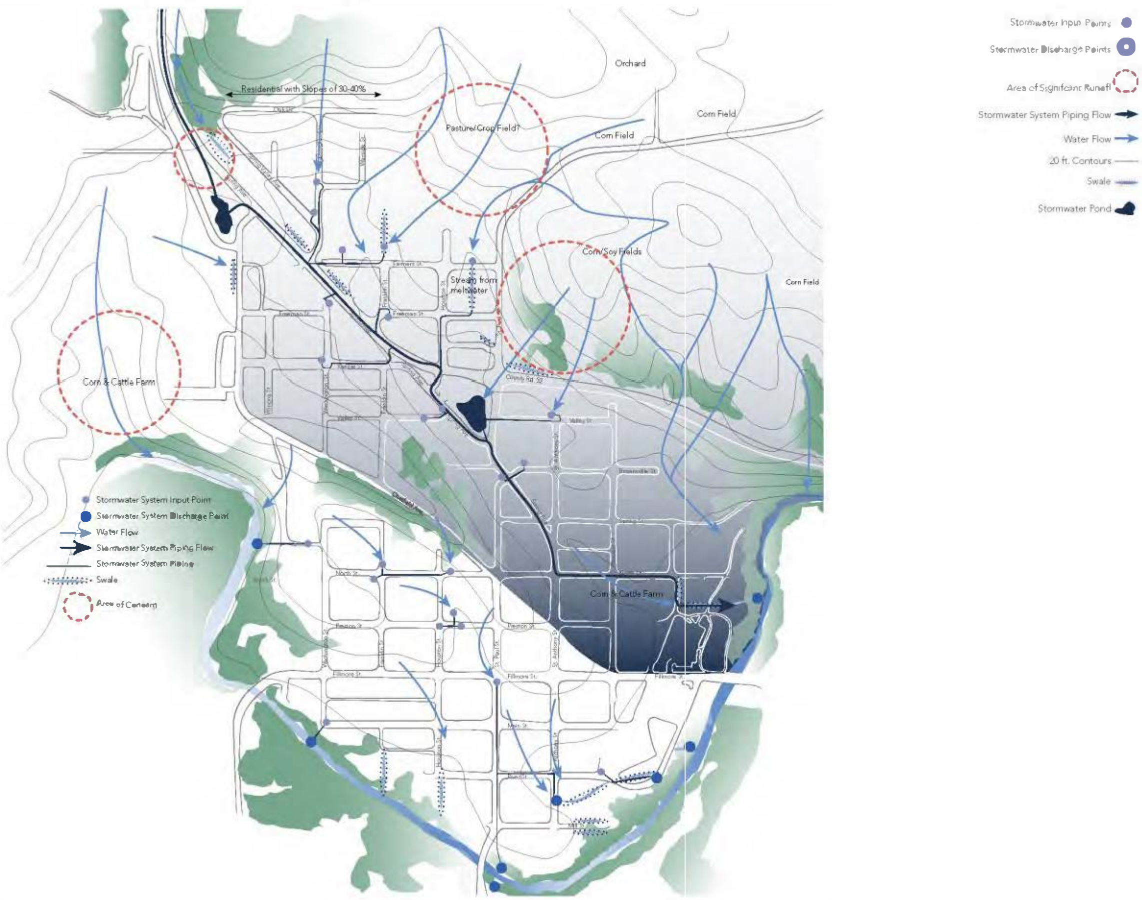
PRESTON LAND COVER



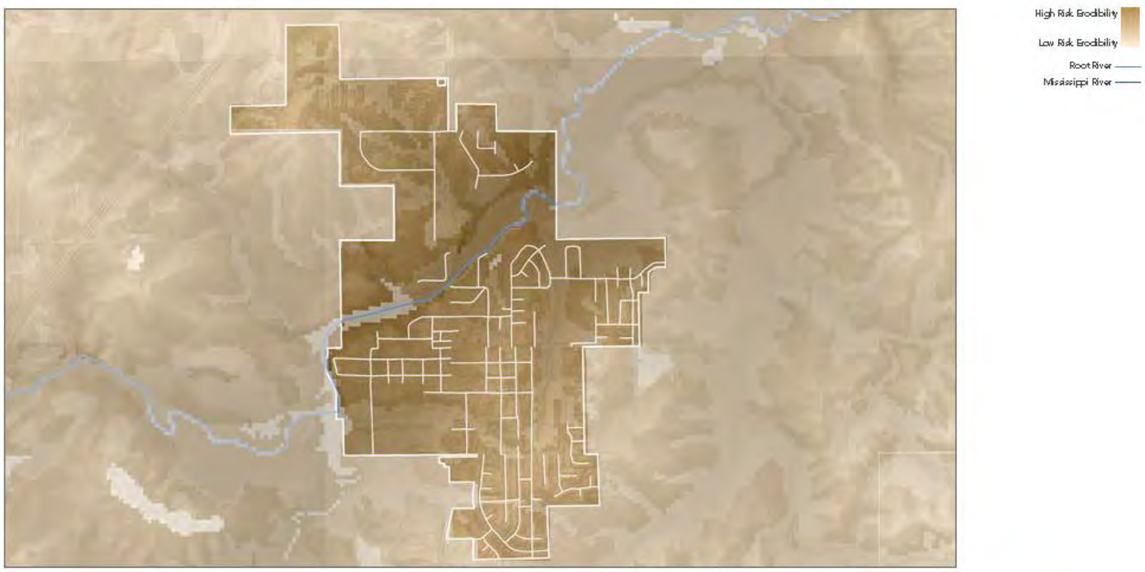


ROOT RIVER LAND COVER

PRESTON'S STORMWATER FLOW: RUNOFF, INPUT AND DISCHARGE POINTS

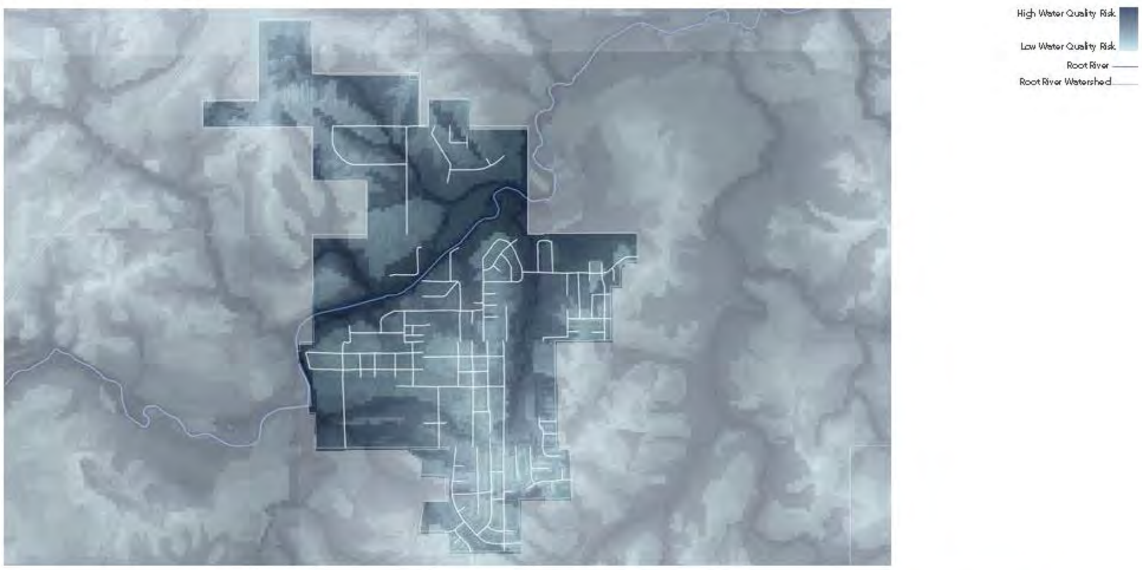


PRESTON SOIL ERODIBILITY



ROOT RIVER SOIL ERODIBILITY & POLLUTANTS

STEWARTVILLE EROSIVE RUN OFF



ROOT RIVER EROSIVE RUNOFF AS A RESULT OF OVERLAND FLOW & PROXIMITY TO WATER

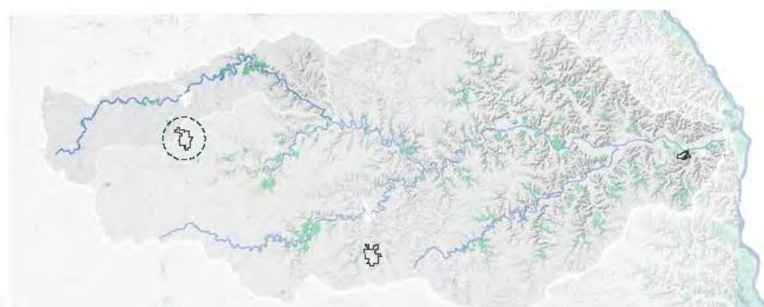
STEWARTVILLE GROUNDWATER CONTAMINATION SUSCEPTIBILITY

ROOT RIVER GROUNDWATER SUSCEPTIBILITY
TO CONTAMINATION

STEWARTVILLE WILDLIFE HABITAT QUALITY

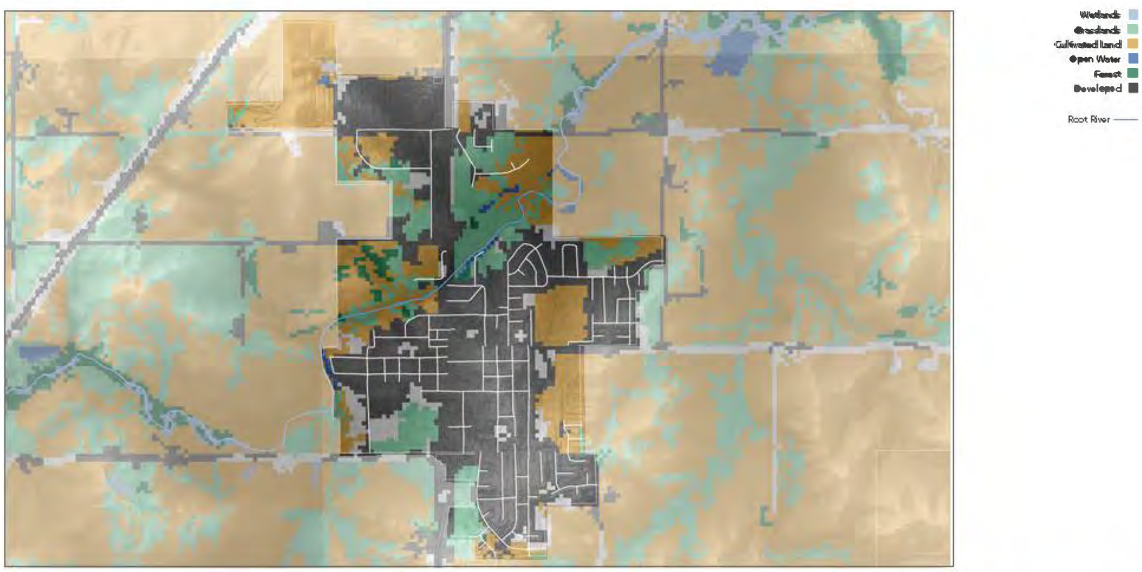
ROOT RIVER WILDLIFE HABITAT

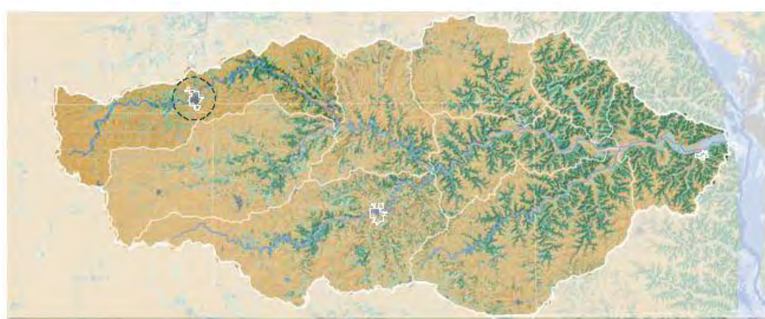
STEWARTVILLE NATIVE PLANT COMMUNITIES



ROOT RIVER NATIVE PLANT COMMUNITIES

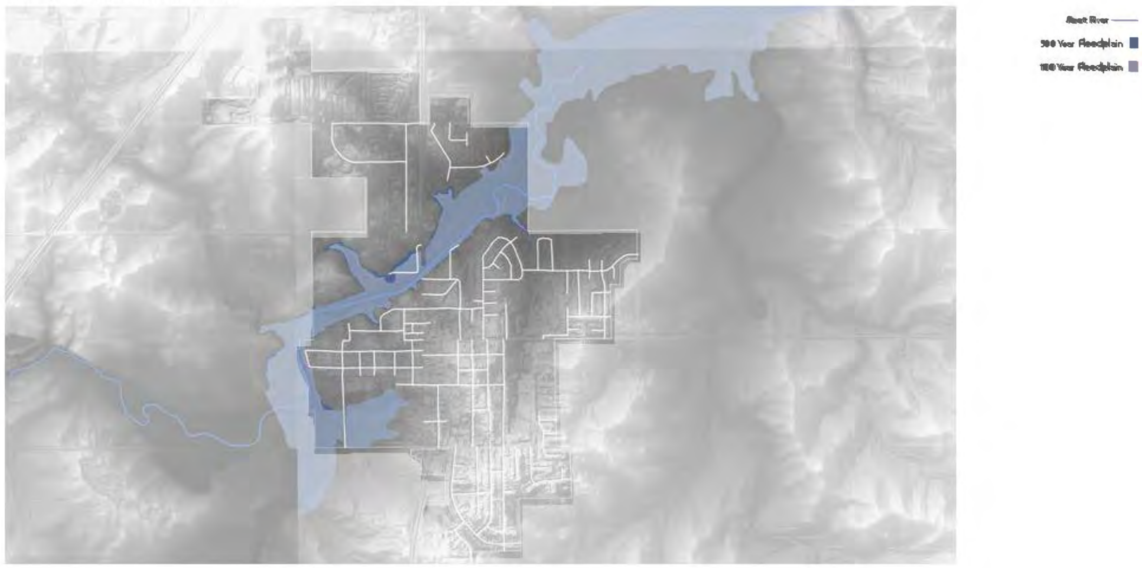
STEWARTVILLE LAND USE





ROOT RIVER LAND COVER

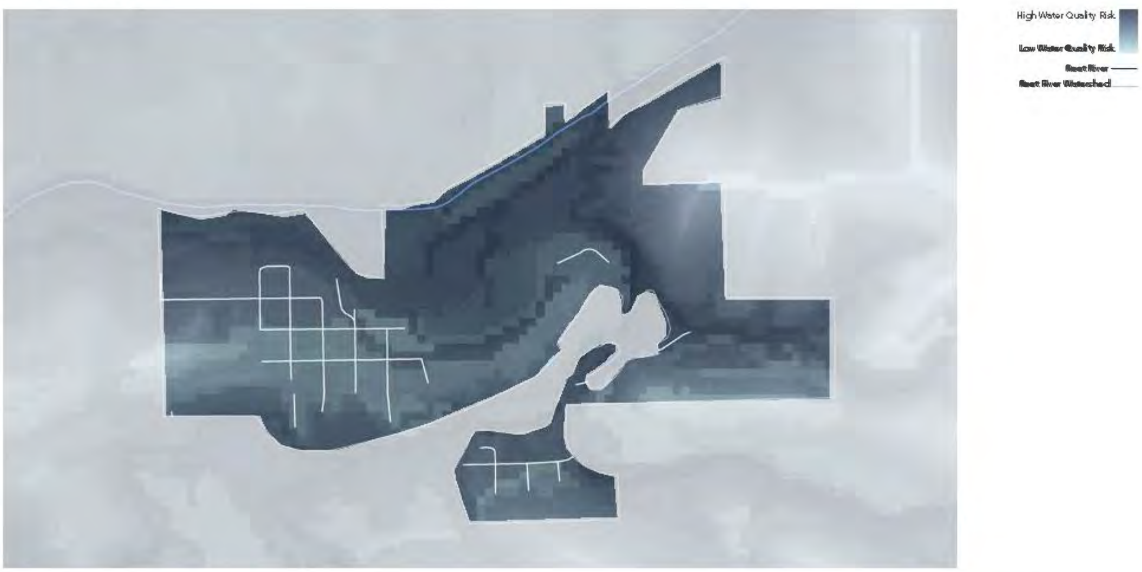
STEWARTVILLE 100 AND 500 YR FLOODWAYS



HOKAH SOIL ERODIBILITY

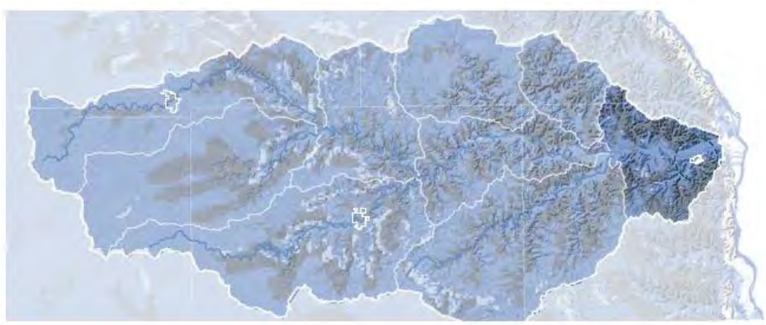
ROOT RIVER SOIL ERODIBILITY & POLLUTANTS

HOKAH EROSIVE RUN OFF



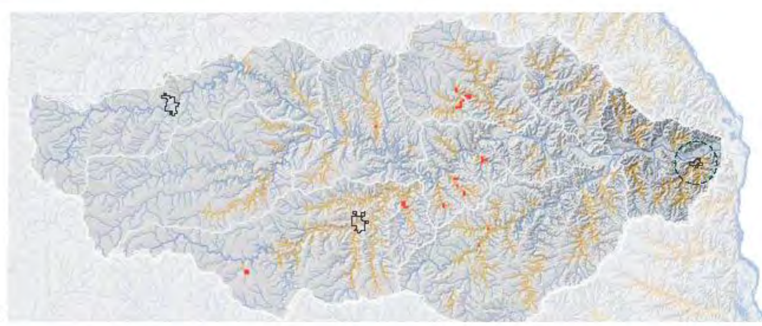
ROOT RIVER EROSIVE RUNOFF AS A RESULT OF OVERLAND FLOW & PROXIMITY TO WATER

HOKAH GROUNDWATER CONTAMINATION SUSCEPTIBILITY



ROOT RIVER GROUNDWATER
SUSCEPTIBILITY TO CONTAMINATION

HOKAH TROUT STREAMS

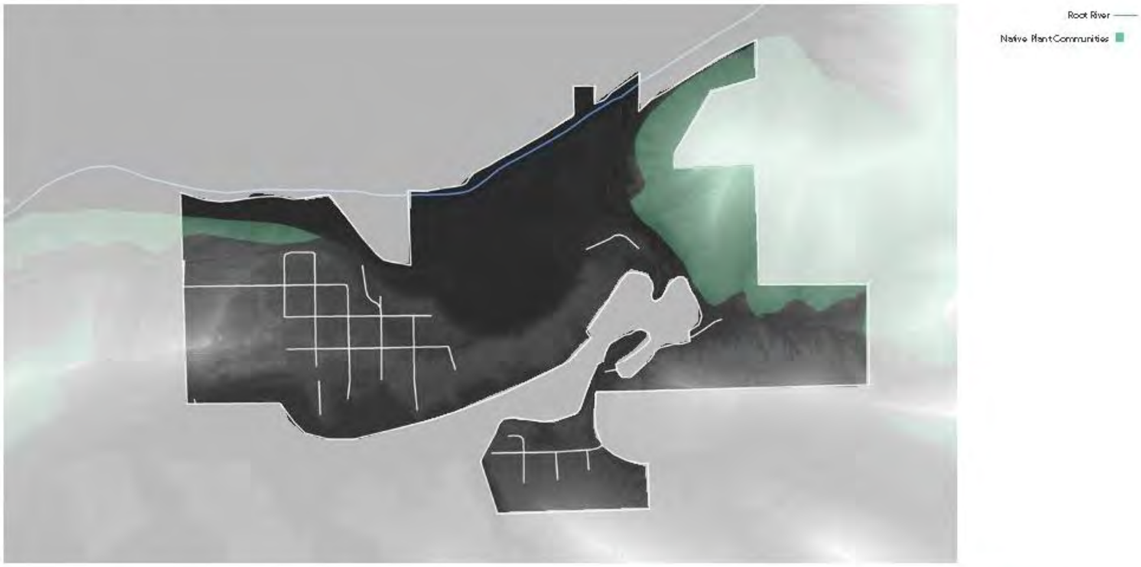


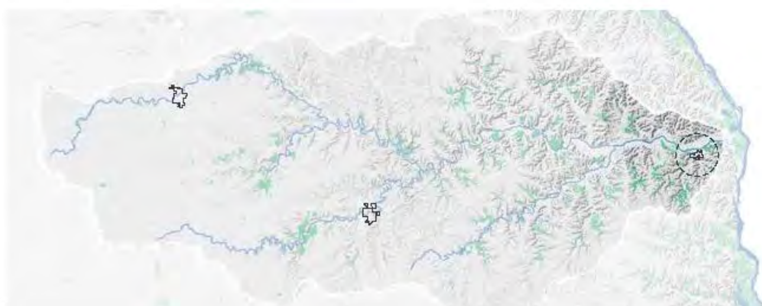
ROOT RIVER FISHERIES AND TROUT STREAMS

HOKAH WILDLIFE HABITAT QUALITY

ROOT RIVER WILDLIFE HABITAT

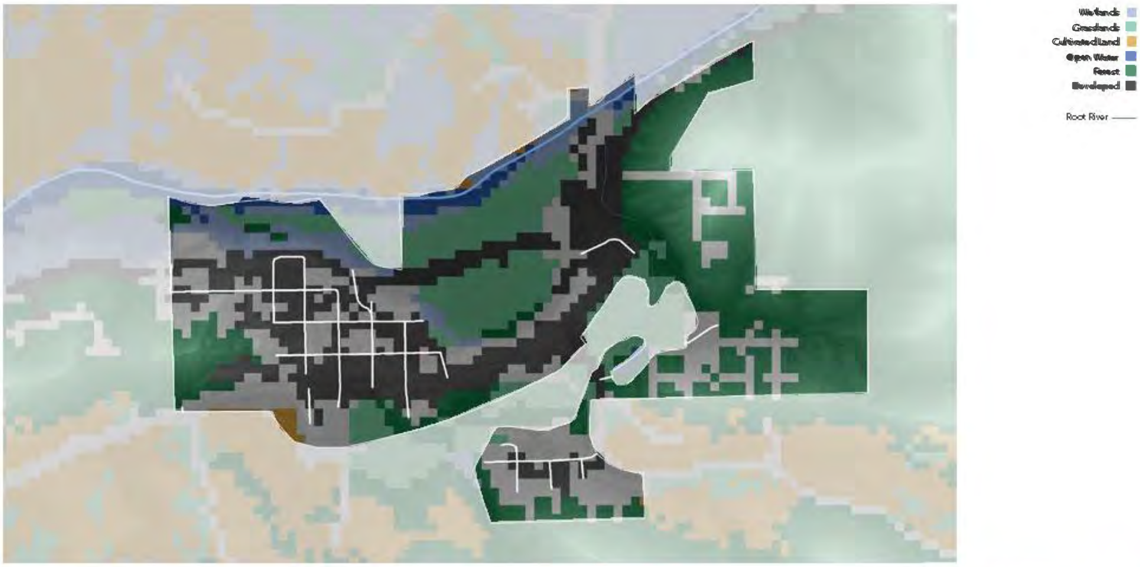
HOKAH NATIVE PLANT COMMUNITIES





ROOT RIVER NATIVE PLANT COMMUNITIES

HOKAH LAND USE



ROOT RIVER LAND COVER

HOKAH **100** AND **500** YR FLOODWAYS

Appendix B

Recommendations for Site Features
For management of both Erosion and Stormwater
Site (S), Preston (P), Watershed (W)

BMP Description	**Kiosk**	**In the Ground**	**Cost?**	**Lawn, Farm, Park, Riverside, Mainstreet, Easement?**	**S, P, W**
Raingarden	X	XX	Cheap(look into county/watershed subsidies)	Lawn	S,P
Live staking	XX	XX	quite cheap, might be able to use cuttings from other city owned land	Riverside, Easement	S-by river
Wetland construction	XX	?(Ideally, but not probable)	Big Bucks? (look into county/watershed subsidies)	Farm, Park, Riverside	W
*Dry Pond/Swale**	X	X		All	S,P?
Curb/Gutter Elimination	XX	XX		Mainstreet	S,P?
Preventative Techniques	XX	?(Signage?)	Low	All	?
Grass Swales	XX	XX		All	W
Green parking	XX	$ Restrictions?		Mainstreet	S (DNR)
Infiltration Trenches		**?**		All	?
Inlet Protection				Mainstreet	?
Permeable Pavement/pavers	X	X$ Restrictions?	Big Bucks	Park, Mainstreet, Lawn (driveway)	S (cost?)
Coconut logs	X	X		Riverside, Easement	S
Erosion Control Blanket		X (Maybe swale area)		Easement, Riverside (not Preston riverside)	S-river

Bioengineering	X	X	Variety of forms	Riverside, park, Easement	S,P,W
Rain Barrels	X	X	<$100	Lawn	S,P
Wood chip biorreactor	X	X	High	Farm	W
Sand filters	X		Med-Hi	Farm?	W?
Stormwater planters	X	X	Hi	Mainstreet	P
Tree Box Filters	X	X	Hi	Mainstreet, Park	P
Vegetated filter strips	X	X		Mainstreet, Park, Farm	W

*This already exists in the park!

- Preventative Techniques: Tarps, material handling etc.

- littering
- disposing of trash and recyclables
- disposing of pet-waste
- applying lawn-chemicals
- washing cars,
- changing motor-oil on impervious driveways
- household behaviors like disposing leftover paint and household chemicals

Appendix C

Interview with Richard Biske, Spring Valley, MN

Where are the existing conservation practices within the watershed? At what scales? How effective have these practices been? Could they relate to the project's site boundaries?

-TNC projects cover the whole watershed

- At headwaters in miller county area, we do wetland construction, excavate out an area for surface area and drain tile,

- Use bioreactors along with the wetland- wood trench that takes in tile water, wood chips, somewhat experimental at nitrogen fixation

- Lower cost wetland designs, new

- Move downstream, engaging with partners like with Donna and other districts to target where projects go

- Erosion potential, thinking about placement more, which is why they are partnering to decide where projects should go
-->in lower root river, we've focused on floodplain restoration, to retire cropland and restore floodplain restoration
1. Land purchase with dnr or USFWS, typically a support role here
2. Conservation easements
--Mississippi river basin initiative NRCS, directed wetland reserve program funds to lower root, bwsr and tnc reinvest in MN to acquire easements

- Some protection work, helping state parks acquire additional land
→ seems like he is all about getting crops off floodplain land
- assisting with Chatfield, floodplain easement taking land along the root river out of corn production and planting it into native grasses maintained by grazing (especially excited about this project)

- engaging with farmer groups, working all the way from headwaters to floodplain, have met with almost all the landowners along the floodplain,
    - ask them to retire land, they have a role in all of this
    - They view the excess sediment and flooding as a problem but are unclear on the causes
-->seems like there is a general understanding that things are changing
- Complicated stuff, lots of quiet reactions
    - Farmers really interested in the science

-change in monthly variation in flows paper--chris lenhart and jon nieber flows, john shotler, 20th century ag drainage creates more erosive rivers, hydrologic processes

- lack of individual land managers accountability
-primarily does outreach through surrogates, conservation districts, contract through them, to help increase their capacity
→ TNC is not an outreach organization
- attend meetings somewhat but not really an outreach group
- don't have a land base down in SE so its hard to do outreach

- ag leadership dialogue sponsored by the environmental initiative, two phase process ag interests and conservation NGOs
    - state env. agencies

Appendix D

Meeting with Kevin Strauss, Education Coordinator for Zumbro Watershed Partnership

1. Has he done a study on the perceptions of stormwater in SE MN?
- campaign called “slow the flow” campaign meant to start shifting attitudes.
- big project on helping people realize where drainwater goes. Why does flooding occur?
http://www.zumbrowatershed.org/projects/active#Slow_the_Flow

- grant funding for a few sources, one with MPCA--> survey of residents of the watershed to get a sense of whats happening and what they could do?

- Increase conversations about clean rivers vs. safe rivers
    --sediments or fecal coliform vs. catastrophic flooding and erosion, increasingly

- flooding is an important event which people are committed to solving

- pairing solutions to flooding with solutions to the other conservation issues, tying them together might help bring in more support

- some other rural surveys, study on vermillion river resident survey, done by a professor in the school of forestry (Mae Davenport)
-> public programming isn’t always the way to get people's attention
    - people don’t attend these kinds of events as much, impact isn’t as broad
- typically not the best way

- Kevin suggests education programs are geared more towards wildlife, history etc. fisheries...shift in programming towards things that folks want to come to (ex. flooding education) and then sneak conservation message at the end
-- requires some infrastructure, but probably only two people
-another example to look into would be the cannon river watershed programs...not as much outreach, more specific grant projects, (zumbro is more public outreach based)

2. What are some best practices for educating on stormwater?
- landowners who have the biggest impact on these issues, don’t typically attend education programs on wildlife etc
→ how do we outreach to those areas those types of landowners?

typically two prong approach:
1. educating average community member, in general
2. when we have outreach with farmers we get other orgs like SWCDs to help out to improve legitamacy
- voluntary practices by farmers and large landowners aren’t enough to make actual changes on the ground

- people are logical, but typically education isn't enough either
- are there other ways, aside from economic incentives to encourage different behaviors?
- lack of regulation for non-point sources pollution
---why its voluntary?
- other options: every farmer, land owner pays taxes- are there tax incentives we could create rather than economic incentives? How can we make this sustainable?
- conservation costs money and polluting is free
- how can we shift the $$????
- some subsidy programs are working towards this, mixed reviews
- perennial problem with ephemeral solutions-- county and local governments have a big influence of taxes, farmers don't really like the idea of anythign bigger than that having control ex. state, fed

- mn extension- sustainability in southeastern mn (http://blog.lib.umn.edu/rsdp/southeast/)
→ research of costs of fast water in olmstead county- what is public cost of water events- roads, other infrastructure and clean up?
→ How do we tie causes to strategy of who pays?

-- enforcement is another issue, trusting folks to do the right thing
- since the tax system already has evaluation structure, wouldn't have to make a new enforcement entity
- once we are really clear on what costs are being incurred, we know where the problem is coming from and we know how to solve it- we know who can make the changes!
- creating a reduction of taxes is pretty easy, really difficult to *raise* taxes
- big picture of what we'd like to do, by lowering taxes might help to create better relationships with farmers who improve situations on their land
→ farmers have a big fear of regulation
- we WILL have to regulate if these issues increase in catastrophic results
-would be really helpful to get some sort of committee together who cares about these issues, helps with legitimacy to have board members and NGO members- rural folks might not be excited about UMN influence.. (city vs. rural)
- how do we get local people with political power involved? Mayors and county governments

3. How to get the word out to people? How to get community involved?
- thats something that a lot of groups have been struggling with
- question whether or not people need more education????
- depends on what you are educating about, most people already know about pollution and turbidity issues
- surprise people! this helps get them engaged
- no one has looked at flow statistics on the Root River- how much has the flow increased in the last few decades?
- check out USGS flow data

→ people don't tend to realize impacts of fast water year round apart from flooding (erosion, turbidity etc.) this is a tangible way to draw people into water issues
- warren netherton, cave manager at forestville/mystery cave state park -- pictures of caves underwater adn caves have watermarks of 400 and 500 year floods
- articles in the local papers tend to be a good way to do some outreach
- public programs aren’t a complete bust, press releases can help with this
-civic engagement training-- how to convene meetings etc.
- root river has an advantage by being a tourist area- more sediments running through the root than the zumbro

Appendix E

<u>Interview with Tiffany Forner, Natural Resource Technician</u>

--how big does it need to be to treat whats draining to it? → higher end draingage information

how do we determine which type of bmp?
- how public is an area?--> do you want some sort of above ground vegetation...so people know what it is, veg that looks nice and explain how its beneficial
- demonstration or education vs. functional
- soils, make sure it will work wherever it

does this soil infiltrate well? if i'm on top of clay, BMPs will be ineffective
- let this inform which plants we will select
- county soil survey maps--> nrcs website, county swcd?

Notes on stormwater U info:
- NRCS website has a WEALTH of site specific information
- is this a site where we could use iron filings to deal with phosphorous? Too advanced?
- don't forget to think about maintenance?

- do we have a target reduction for downstream turbidity or fecal coliform? Is this big enough to make that kind of difference?
- where do we fit in the areas comprehensive plans? are there any resources for us there?

- tapping in to gardening communities is important
- Lake association?
- do we have money for mailings? any "friends" organizations? flyfishermen? boat enthusiasts?
- finding exising social networks is KEY to outreach, otherwise things get much more expensive

- What are street sweeping practices?
- public ed on lawn waste, curbs etc.?
- natives?

Appendix F

GIS Layers and Sources

1. **Trout Streams and Aquatic Management Areas**
   a. This layer shows legally designated trout streams and trout stream tributaries as identified in Minnesota Rules Chapter 6264. Last updated 2009.
   b. This layer also shows land records in the layer depict lands administered by the DNR Division of Fish and Wildlife, Section of Fisheries. Updated 1999. Close to Preston is the Lanesboro Hatchery and an aquatic management area on Gribben Creek. These area essentially just waters that are managed by the state.

2. **Groundwater Susceptibility**
   a. Abstract from DNR metadata "A broad, generalized interpretation of ground water contamination susceptibility for the state, based on modeling relying on data inputs from the MLMIS40 (40-acre raster) soils and geology data, with additional geology inputs. This layer is not appropriate for site-specific use."
   b. Inputs from these layers and sources:

LAYER: SOIL MATERIALS
DESCRIPTION: Generalization of rooting zone and substratum soils from Minnesota Soil Atlas Series
DATA SOURCE/PUBLISHED SCALE: Minnesota Soil Atlas Series, 1969-1981; University of Minnesota Department of Soil Science/Agricultural Experiment Station/USDA-SCS; 1:250,000
MINIMUM MAPPING UNIT: 600 acres
SCALE OF ENCODING: 40 acres
COMMENTS: Data compiled at 1:125,000 scale.

LAYER: RECHARGE POTENTIAL
DESCRIPTION: Derived from Hydrologic Soil Groups, an element from the Minnesota Soil Atlas Series
DATA SOURCE/PUBLISHED SCALE: Minnesota Soil Atlas Series, 1969-1981; University of Minnesota Department of Soil Science/Agricultural Experiment Station/USDA-SCS; 1:250,000
MINIMUM MAPPING UNIT: 600 acres
SCALE OF ENCODING: 40 acres

LAYER NAME: AQUIFER MATERIALS
DATA DESCRIPTION: Derived from Quaternary Hydrogeology, Paleozoic

Lithostratigraphy of Southeastern Minnesota, and Bedrock Hydrogeology Maps
DATA SOURCE/ PUBLISHED SCALE: 1. Hydrogeologic Map of Minnesota: Bedrock Hydrogeology (Mn Geological Survey Map S-2), 1:500,000; 2. Paleozoic Lithostratigraphy of Southeast Minnesota (Mn Geological Survey Map M-51, 1:500,000); 3. Hydrogeologic Map of Minnesota, Quaternary Hydrogeology (Mn Geological Survey Map S-3), 1:500,000
MINIMUM MAPPING UNIT: approx. 640 acres
SCALE OF ENCODING: 40 acres
COMMENTS: Original Maps compiled at 1:250,000 scale

LAYER NAME: VADOSE ZONE MATERIALS
DATA DESCRIPTION: Derived from Quaternary Geology, Paleozoic Lithostratigraphy of Southeastern Minnesota, Bedrock Hydrogeology, and Depth to Bedrock maps.
DATA SOURCE/ PUBLISHED SCALE: 1. Hydrogeologic Map of Minnesota: Bedrock Hydrogeology (Mn Geological Survey Map S-2), 1:500,000; 2. Paleozoic Lithostratigraphy of Southeastern Minnesota (Mn Geological Survey Map M-51), 1:500,000; 3. Geologic Map of Minnesota: Quaternary Geology (Mn Geological Survey Map S-1), 1:500,000; 4. Depth to Bedrock (Mn Geological Survey Map S-14, 1:1,000,000.
MINIMUM MAPPING UNIT: approximately 640 acres
SCALE OF ENCODING: 40 acres

3. **Impairment information** came from this document “Root River Watershed Monitoring and Assessment Report” written by MPCA

4. **Water Quality Risk** or “Erosive run off as a result of overland flow and proximity to water” came from MN Board of Water and Soil Resources

This data layer represents a general risk score for surface water quality on a 0-100 basis, 100 being the highest risk. Larger values indicate areas that are more likely to contribute overland runoff than smaller values. Half of the risk score was determined by Stream Power Index (SPI) values. Five terrain zones were created in Minnesota that represents physiographic regions with similar slope characteristics; these were created in attempt to stratify slope related data statewide, and remove bias from landscapes with extremely high relief. Large values isolated from a statewide 30-m SPI grid were isolated in each of these terrain zones to create a critical area layer where overland erosion is likely to occur. SSURGO soil polygons were then used to overlay these data; the proportion of SPI critical areas within each SSURGO polygon was used to assign a percentile rank to these polygons statewide, the larger the proportion of critical SPI data, the larger risk score for that polygon. This percentile rank again represents 50 of the total 100 points for this risk layer. The remainder of points was determined by calculating proximity from SSURGO polygons to the nearest DNR 24k surface water feature (Lake or

Intermittent/perennial stream). A percentile rank of these proximity values assigned to each SSURGO polygon represents the final 50 points, where the highest risk scores are given to the polygons closest to water features.

5. **Land Cover**

This is a level one land covertype map for the entire state of Minnesota representing the year 2000. The covertype was derived via multitemporal, multispectral supervised image classification of satellite imagery aquired by the Landsat TM and Landsat ETM+ satellites. Seven level one land covertype classes were: urban, agriculture, grassland, forest, water, wetland and shrubland.

6. **Native Plant Communities**

This data layer contains results of the Minnesota County Biological Survey (MCBS). It includes polygons representing the highest quality native plant communities remaining in surveyed counties. These native plant communities are important areas for conservation. Native plant communities (sometimes also referred to as "natural communities") are groups of native plants that interact with each other and their surrounding environment in ways not greatly altered by modern human activity or by introduced plant or animal species. These groups of native species form recognizable units, such as an oak forest, a prairie, or a marsh, that tend to repeat across the landscape and over time. Native plant communities are generally classified and described by considering vegetation, hydrology, land forms, soils, and natural disturbance regimes. The native plant community types and subtypes in this data layer are classified primarily by vegetation and major habitat features. Classification and inventory of native plant communities is an ongoing effort of the Natural Heritage and Nongame Research Program and the Minnesota County Biological Survey. The Minnesota County Biological Survey located higher quality native plant communities using aerial photo interpretation followed by field survey of selected sites. Areas that were not mapped as native plant community polygons primarily represent: 1) land where modern human activities such as farming, overgrazing, wetland drainage, recent logging and residential and commercial development have destroyed or greatly altered the natural vegetation; and 2) native plant community polygons that were below minimal size criteria. Note: some areas that were not mapped are important for conservation. They may include habitat for native plants and animals, corridors for animal movement, buffers surrounding high quality natural areas and open space, and target areas for restoration.

7. **Wildlife Quality Habitat**

This data layer represents a general score for wildlife habitat quality on a 0-100 point scale, 100 being the highest risk. Larger values indicate higher potential wildlife habitat quality. The habitat mapping used in this plan was updated from the work done as part of Minnesota's

Statewide Conservation and Preservation Plan. The primary goal of habitat mapping was to collate the available information for Minnesota that can be used to prioritize important areas for conservation (protection, acquisition, restoration) by integrating both positive (resources) and negative (threats to resources) information on biodiversity, habitat quality, outdoor recreation (e.g., hunting and fishing), and water quality. Positive components included features such as known occurrences of rare species, sites of biodiversity significance, or high levels of game species abundance, while negative components included the dominant drivers of environmental change as identified in Phase I of the plan. Negative influences on natural resources included such information as human development, land use, and road density. By acquiring and objectively processing information related to these components, it was possible to rank areas in Minnesota according to their conservation priority

8. Soil Erodability

This data layer represents a general risk score for potential soil erosion on a 0-100 point scale, 100 being the highest risk. Larger values indicate soils that have a higher potential to erode if no conservation practices were in place and overland sheet or rill runoff was present. A subset of the Universal Soil Loss Equation (USLE) was used to determine potential erosion values. The USLE is a multiplicative equation using the formula A =R x K x LS x C x P where: " A = potential long term average annual soil loss in tons/acre/year. " R = rainfall and runoff factor " K = soil erodibility factor " LS = slope length-gradient factor " C = crop/vegetation and management factor " P = support practice factor The R (Rainfall), K (Soil Erodibility), and LS (Length/Slope) factors were used and calculated based on NRCS spatial and tabular SSURGO soils data, statewide county based climate maps, as well as mathematical formulas based on standard USLE calculations. SSURGO stands for Soil Survey Geographic Database. The crop/vegetation and management factor and support practice factor were not used. This is because there are no reliable statewide spatial data that represent these factors. Although there exist statewide data depicting current cropping practices, there are no statewide data representing current tillage methods (e.g. fall plow, ridge tillage, no-till) or support practice (e.g. cross slope, contour farming, strip cropping) that are required for these calculations. Furthermore these factors are temporal and will therefore shift over time. Since only non-management factors were used, the resulting data layer should be viewed as a "worst-case" scenario, i.e. highest potential soil erosion of bare soil with no mitigating land use practices in place. Although quantitative soils loss numbers (tons/acre/year) may be exaggerated under this model, the resulting data layer is used here in a qualitative, comparative capacity in order to compare the relative differences in soil loss risk between various parts of the landscape.

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